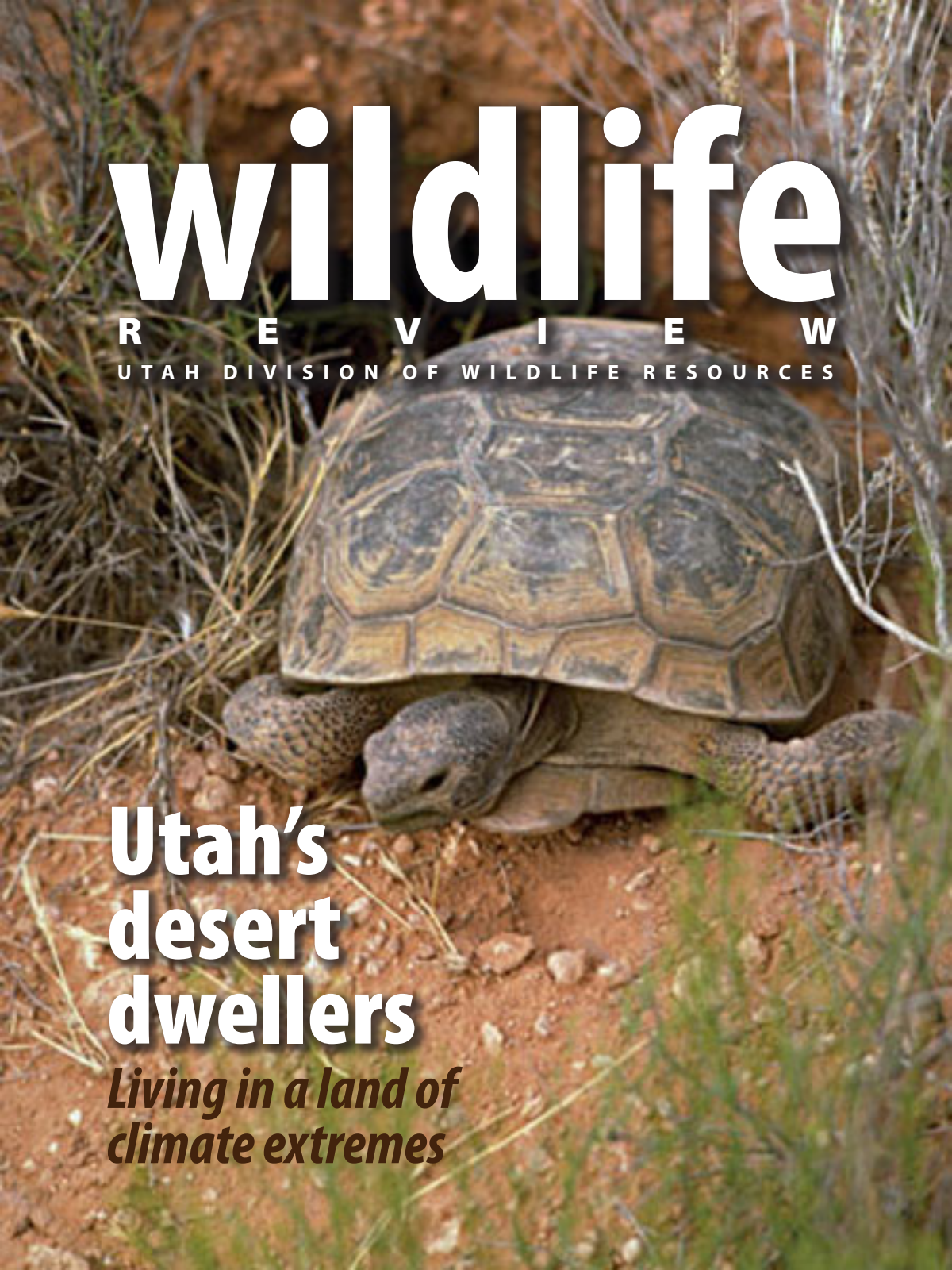

wildlife

REVIEW

UTAH DIVISION OF WILDLIFE RESOURCES

Utah's desert dwellers

Living in a land of climate extremes

"…the dry and sunlashed desert, is a good school in which to observe the cleverness and infinite variety of techniques of survival under pitiless opposition. Life could not change the sun, or water the desert, so it changed itself… The desert has mothered magic things."

—John Steinbeck
Travels With Charlie, 1962

Utah's desert dwellers

by Diana Vos
Project WILD Coordinator

Last summer sure seemed hot and dry in Utah. It reminded many of us that we truly live in a desert.

To cope with the heat, many of us stayed inside, turned our air conditioners on full blast and downed a lot of cool, refreshing beverages right out of the refrigerator.

Not all of Utah's residents got

to enjoy the luxury and convenience of air-conditioning and refrigerators, however. The plants and animals that live in Utah's deserts have developed various ways to tolerate the challenges of living in a land of extremes.

Hot and cold deserts?

Most people think that all deserts are hot. Most deserts are, but eight of the world's 21 deserts are actually classified as cold deserts because they regularly receive snowfall in the winter.

So what makes a desert a desert? Though all deserts have different plant and animal life, and they're all different in their size and location, they share two common characteristics: all of them are dry and they have a high rate of evaporation. Deserts generally receive less than 10 inches of rainfall per year. They evaporate more than that, however, which makes them very dry.

North America has four deserts: the Great Basin, Mohave, Sonoran and Chihuahuan. Portions of two of these deserts, the Great Basin and the Mojave, are located within Utah.

Great Basin Desert

The Great Basin Desert is the largest of North America's deserts, covering about 190,000 square miles. It's bounded on the west by the Sierra Nevada and on the east by the Rocky Mountains. A series of valley floors, called basins, run across this large expanse of land at an elevation of about 4,000 feet. These basins include smaller north-to-south mountain ranges that parallel each other. These ranges are usually 7,000 to 10,000 feet high, but some of their peaks reach more than 12,000 feet. About 35 to 50 percent of Utah's land falls within the Great Basin Desert.

The Great Basin is a cold desert. Even though you might think the region's high mountain ranges would capture great amounts of moisture, the Great Basin is in the rain shadow of the even higher Sierras. The Sierras capture most of the moisture from the Pacific winds and prevent it from reaching the area. Annual precipitation averages four to 10 inches, but most of the precipitation that falls in the Great Basin (60 to 80 percent) falls in the form of snow that melts in the spring. Much of the

precipitation the region receives quickly evaporates in the dry desert environment. Some of the precipitation that doesn't evaporate sinks into the ground and becomes groundwater. The rest runs into streams and collects in short-lived lakes on the valley floors called playas, that eventually evaporate. The Great Basin is literally a basin (or actually a series of basins) since the water that falls in the region never flows out to the ocean.

Summer temperatures in the Great Basin are hot, but not excessively hot, only occasionally reaching 100° F. Overall, temperatures average 45 to 55° F.

Much of the Great Basin Desert (45 percent of it) is covered by sagebrush. Saltbrush dominates in the lower valleys and in the playa regions where salts have accumulated in the soils. In the wetter regions to the north, the proportion of grasses to shrubs increases, giving rise to a vegetation type known as sagebrush steppe. Other shrubs in the region include Mormon tea, greasewood, blackbrush, snakeweed and rabbit brush.

As the elevation increases on the slopes of the various mountain ranges, the vegetation changes to open

woodlands that consist of Utah juniper, single-leaf pinon (mostly in the southern areas) or curl-leaf mountain mahogany (in the northern areas), followed by bands of coniferous forests and peaks of bristlecone pine.

Mojave Desert

Covering about 54,000 square miles, the Mojave Desert (also spelled Mohave) is the smallest of North America's deserts. It extends from southeast of the Sierra Nevada in California to the Colorado Plateau and is bounded on the north by the Great Basin Desert and on the south by the Sonoran Desert. In Utah, the Mojave Desert is found only within the extreme southwestern corner of the state.

The Mojave Desert is characterized by parched mountains that rise abruptly from alternating plains or basins. Elevations range from 300 feet below sea level to 11,000 feet above. Within Utah, the elevation of the Mojave ranges between 2,500 and 3,500 feet.

Classified as a hot desert, air temperatures in the Mojave Desert sometimes reach 115° F in the summer,

and ground temperatures can get as high as a searing 140° F! Precipitation, which falls mostly as rain in the winter, averages only five inches per year, making the Mojave the driest of all of North America's deserts.

Though very hot and very dry, the Mojave Desert supports an amazingly diverse array of unique and fascinating plants. Valleys are filled with widely spaced creosote bush, Mojave sage and mesquite. Other shrubs include shadscale, brittlebush, desert holly, white burrobush and various yuccas. Several cacti, including chollas, barrel cacti, prickly pear and beaver tail cacti, are scattered throughout the desert. In the spring, following the winter rains, a vast array of wildflowers carpet the desert floor.

About one-fourth of the Mojave's plants are endemic to the region, meaning they're found nowhere else in the world. These include the Joshua tree, among the most famous of the region's species. A species of yucca, the Joshua tree is found along the edges of almost the entire Mojave Desert, and also along the southeastern margin, mainly on cooler, moister slopes.

Desert plants

Desert plants use several strategies to survive the limited moisture and extreme temperatures their desert environment provides.

Water hoarders

Many desert plants can store water. Called succulents, these plants store water in their fleshy leaves, stems or roots. Most succulents also have shallow roots that can quickly absorb water from rain and dew. Cacti and agave are two examples of succulents.

Many desert plants retain water by employing crassulacean acid metabolism (CAM), a different type of photosynthesis that allows them to make food during the day, without wasting water.

During normal photosynthesis, plants open microscopic holes in their leaves during the day. Called stomata, these leaves allow carbon dioxide (CO_2) to enter the plant and oxygen (O_2) to exit it. However, when plants open their stomata, water can escape, especially in the heat of the day.

Though water is scarce, desert plants find ways to thrive.

In CAM photosynthesis, the plants take CO_2 in by opening their stomata at night, when it's cooler. The CO_2 they take in is stored in the form of crassulacean acid. As the next day begins, and the temperatures rise, the crassulacean acid is transformed back into CO_2 for use in photosynthesis.

The waiting game

Another strategy desert plants use is called drought dormancy. This strategy allows plants to survive periods of drought by conserving water through reduced metabolism. During this process (also called idling metabolism) the plant slows its metabolism down by recycling CO2 and using stored water, just enough to keep the plant alive. Because their metabolism is idling, these plants can start full-speed metabolism faster, when the conditions are right for growth and reproduction, than plants that become completely dormant.

To avoid losing water, many desert plants drop their leaves during drought or times of extreme heat. Examples of plants that do this are mesquite, acacia, palo verde, ironwood trees, creosote and ocotillo.

"But if they drop their leaves, how do they photosynthesize?" you might ask. Some don't photosynthesize. Instead, they remain dormant until they can grow new leaves. Octillo, for example, may bloom, produce seeds, lose leaves, go dormant and then re-grow leaves, repeating this cycle up to five times in

a year. Others have chlorophyll not only in their leaves, but in their stems or bark too. This allows them to photosynthesize without leaves.

Store water or stay wet

Avoiding drought is another strategy some desert plants employ. Annuals such as desert sand verbena and desert paintbrush avoid drought by growing only during the spring season. These desert plants dry up and die during the summer, but moisture, oil, fat, sugar and protein are stored in their seeds. The seeds are protected by a thick coating. That coating is nearly waterproof and contains anti-germination chemicals. When enough rain falls, the chemicals that prevent germination are washed away, the seed germinates, a new plant grows and the plant starts producing seeds. Since rain doesn't always fall every year, these annuals are more aptly called ephemerals. When the rain comes, they're the sprinters of the plant world, sending out flower stalks and blooming in just a few days.

Long, deep taproots are another way plants avoid

drought. Long taproots can reach below ground to the water table, where an almost constant source of water is available. This water keeps the plant alive throughout the hot and dry season. Mesquite and other phreatophytes utilize this strategy. The taproots of these two plants average 60 feet long.

Waxy or oily coatings that many plants have on their leaves and stems is another way that plants retain water. Creosote and jojoba are two examples of this. These waxes and oils, which are shiny, also reflect light and reduce the temperature of the leaves. Salt excretions on leaves can increase albedo (reflectivity) too. Cooler leaves lose less water.

Other plants create their own shade through hair-like projections (trichomes) on their leaves. Having small leaves or no leaves, as mentioned before, also reduces the loss of water because the leaves have a smaller surface area. Cacti, for example, have no leaves. The spines of cacti also help reduce water loss by providing shade and collecting moisture.

Desert wildlife

The limited water in the desert determines the types of organisms that can live in them and drives the adaptations these organisms must possess to survive. Animals that live in the desert use a variety of intriguing strategies to minimize the amount of water they lose and to tolerate the extreme heat.

Can't stand the heat? Get out of the kitchen

Many desert birds avoid the heat by limiting their activity to dawn and to within a few hours of sunset. During the hottest parts of the day, they retire to a cool, shady spot. Others, such as kingbirds, remain active during the day, but regularly perch in the shade to stay cool.

Certain desert lizards also stay active. They move fast over the hot desert sands, stopping in cooler areas provided by shade. Some lizards, including collared, zebra-tailed and leopard lizards, have long legs and toes that lift their body high off the ground and reduces the

amount of heat they absorb. Sidewinders stay cool by moving sideways. This sideways movement results in only two short portions of their bodies touching the scorching sand at any one time. White-tailed antelope ground squirrels make their own shade by using their bushy tail to shield their body from the sun.

A variety of desert animals, including rodents, kit foxes and tarantulas, escape the high temperatures by burrowing below the surface of the ground. When the temperatures drop at night, they come out to hunt. Some rodents keep the hot air out by plugging the entrances to their burrows. Other desert animals remain in their burrows during long periods of extreme temperatures and drought. Some ground squirrels even enter a state of aestivation and remain dormant through the hottest part of the summer.

Desert tortoises retreat to long, underground burrows they've dug to escape the summer heat. They also spend the cold of winter deep within their burrows in a dormant state. Gila monsters also spend about 95 percent of their

Lynn Chamberlain

Tortoises use burrows to stay cool.

life in a dormant state. Desert bighorn sheep sometimes retreat into caves in the rocky foothills to escape the heat.

Spadefoots remain dormant deep underground until the summer rains fill the ponds. Raindrops hitting the ground stimulate the toads to emerge, breed, lay eggs and feed to replenish their body reserves. They do all of this in a very short period of time before burying themselves again in the cooler, moister ground. The ability to rapidly produce young is an adaptation that helps ensure successful breeding before the small, temporary pools dry up.

Some spadefoot tadpoles, including tadpoles of the Great Basin spadefoot in Utah, also develop into two morphs (forms). One form feeds on vegetative matter and detritus and requires more time to grow. The other develops faster and becomes carnivorous, sometimes turning to cannibalism to ensure they survive as the pools disappear. Some species of arthropods, such as fairy shrimp, don't survive as the pools dry up, but their eggs do. Their eggs hatch in new ponds and playas that form when the rain falls at a later time.

Keeping your cool

Desert animals use some clever mechanisms to dissipate the heat they absorb from their surroundings. For example, owls, poorwills and nighthawks pant. This panting causes water in their throats and mouths to evaporate, and that cools them off. They need to have a good supply of water to cool down this way, though.

Jackrabbits stay cool through their large ears. Their ears are laced with blood vessels that carry warm blood to the surface of their skin, which allows them to cool as they rest in the shade. When temperatures reach stressful or dangerous levels, researchers have found that some jackrabbits will actually aim their large, highly vascularized ears at the center point of the north sky, towards Polaris. Even though this star cannot be seen during the day, they somehow know where to aim their ears. The heat sink associated with this extremely cold portion of the sky pulls excessive heat from their ears and cools their bodies.

In deserts, having a light color is often an advantage, and many desert animals are paler in color than similar

Jackrabbits release heat through their large ears.

species are in other regions. Pale colors not only absorb less heat, they also provide camouflage that makes it difficult for predators to see the animal in the desert landscape.

Turkey vultures, which are dark in color and absorb heat more readily, counteract the heating by excreting waste onto their legs and feet. As the moisture from the waste evaporates, much of their body heat is carried

away. Turkey vultures also spend time soaring high on thermals of cooler air to avoid hot midday temperatures.

Getting water however you can

Finding water to drink in the desert can be tricky. The desert tortoise's solution is to dig catch basins in the soil to catch the periodic rains that fall. The tortoises remember where the basins are and return to them when it rains.

Some desert animals get water from the foods they eat. For example, the desert tortoise, the desert iguana and the chuckwalla get most of the water they need by feeding on moist plants. The desert tortoise can also store about a quart of water in its bladder. If it's disturbed, it may void its bladder as a defense mechanism. This loss of water can be fatal to the tortoise.

Rattlesnakes and other desert snakes absorb most of their moisture from their prey. Many insects tap fluids, such as nectar or sap, from the stems or the various parts of the plants they eat. This insect life, in turn, supplies moisture to lizards and birds, including roadrunners

and bats, which feed on the insects. Hummingbirds and nectar-feeding bats get the water they need in the nectar they drink from flowers. The larvae of the tarantula wasp get moisture from the helpless tarantula their mother has paralyzed, laid her eggs upon and placed in the nest.

Kangaroo rats can even get moisture from the dry seeds they eat. They make water metabolically through the process of digestion. They also have special kidneys, with a great number of microscopic tubules, which extract most of the water from their urine and return it to their blood. Specialized tissue in their nasal passages also recaptures much of the moisture they would normally lose when they exhale air. They also seal off their burrows to block out the midday heat and retain the small amount of moisture that they do exhale through their breathing.

As you can see, Utah's desert plants and animals have found ingenious ways to deal with the extreme heat and limited water in their desert environments.

Getting WILD! Utah's WILD Notebook **is produced by Utah's Project WILD program. WILD workshops, offered by the Utah Division of Wildlife Resources, provide teachers and other educators with opportunities for professional development and a wealth of wildlife education activities and materials for helping students learn about wildlife and its conservation. For a current listing of Project WILD educator workshops, visit the Project WILD web site at** *wildlife.utah.gov/projectwild* **or e-mail** *DianaVos@utah.gov***.**

Web resources

www.wildlife.utah.gov/projectwild/newsletters/94spring-gw.pdf

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www.digital-desert.com/wildlife/desert-animals.html

www.fhsu.edu/biology/Eberle/DesertSW/DesertPlants.htm